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THE NATIVE ANIMAL RESOURCES OF THE STATE.

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The native animals of this State were once its most important economic asset, furnishing perhaps the larger and certainly the more highly valued part of the food, and all the clothing, of its inhabitants, and almost the total mass, also, of its merchantable products. Now, however, they are reduced to such economic insignificance that few would be found to object seriously, on merely economic grounds, to a fiat of extermination to be issued against our whole native fauna, if the injurious might go with the beneficial species. We would cheerfully sacrifice what is left to us of our native fish and game if we might pile upon the same altar the vast destructive host of what we commonly call our insect enemies, together with the gophers, mice and moles of the fields and the owls and the hawks of the air.

Permit me to try to sketch rapidly the nature, the process and the causes of this transformation, in the hope that we may see to what extent it has been, and perhaps still is, normal and helpful to us, and to what extent, if at all, it has gone, or is likely to go, too far in any part of its movement—at what points, if at all, it may be improved upon for our purposes, or may perhaps be profitably arrested or reversed.

The chief pressing and universal requirements of our aborigines were food, clothing, shelter, instruments of transportation, and articles of barter, the last especially important after white traders began to come among them. Our native Illinoisans were mixed feeders, like the North American Indians generally, but with a marked preference for animal food. We have no data sufficiently detailed for an intelligent judgment of the relative importance to be assigned to the corn, beans and squashes, on the one hand, raised by their women on their bottom-land fields, and to the products of their hunting, on the other; but our Indians were clearly hunting tribes—governed in their movements to and fro by the migrations of their game—rather than truly sedentary agricultural people like those farther to the south. Hunting

and fishing were their principal economic pursuits, and their mental and physical development was most strongly influenced by their contact with the animals of their environment, which they must outwit or master or outrun in order to gain a living for themselves and their families. Their fuel was, of course, mainly wood, with buffalo chips, perhaps, as an occasional convenience. Their clothing was almost wholly made from the skins of animals, with buckskin as the chief material. Their boats and their permanent shelters were mainly of forest products, the frames of their huts of wood and the covering of mats woven from strips of bark; but the objects of their barter, particularly with the whites, were almost wholly furs and skins obtained by hunting and trapping.

Notwithstanding this steady draft upon the native animal resources of the country, the original number of our Indian inhabitants—estimated at something like 200,000 for all North America east of the Mississippi River—was too small to affect in any overwhelming way the general system of animal life, which would apparently have gone on but little changed if they had been suddenly exterminated. In Illinois they probably influenced the fauna of the State more powerfully by their prairie fires than in any other way.

The first appearance of the white man made little or no alteration in these relations, for the discoverers and explorers of our territory necessarily lived much as the Indians did; and the hunters and traders and earliest squatters, who were in part the successors of the explorers, were similarly dependent on the untamed products of the country—especially so upon its animals, which gave them not only the major part of their food but also the greater part of the materials of their trade. Barter for furs, as we all know, was almost the sole business of the first business men of the State, and their food was probably even more largely animal than that of the Indians among whom they lived, since they killed their own game, but rarely planted any crop. An employee of the American Fur Company, stationed, in 1819, at an Illinois River post near the present site of Hennepin, says, in his recently published autobiography:

"Our roasted meat . . . was placed in the large wooden bowl on the table, and each one helped himself by cutting off with his knife and fingers as much as he desired. Usually we had nothing else on the table except honey. The wild turkey was used as a substitute for bread, and when eaten with fat

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venison, coon or bear, is more delicious than any roast can be. One of our luxuries, which was reserved for special occasions, was corn soup, and this was always acceptable. . . . From the ponds we gathered the seeds of the lotus, which we used for coffee, our ever-filled honey-trough furnishing the sweetening. Our supply of salt and pepper was rather limited, and these were used only on special occasions."*

It was not, in fact, until the farm-maker and the town-builder appeared on the scene, bringing in a much denser population than could live on the mere surplus product of our native plants and animals—the bare interest on our capital in plant and animal resources—that this primitive system of maintenance broke down. When too heavily drawn upon, the animals of the State began to yield a smaller instead of a larger product, because an excessive demand had the effect to reduce the number of producers; and a substitution of more productive resources became a necessity. The white man being substituted in rapidly increasing numbers for the scanty and stationary Indian population, wheat, oats and corn and the tame meadow grasses were substituted for the wild plants of the prairie turf, and to some extent for the growths of the forest; beef cattle, pigs and sheep were substituted for buffalo, bear and deer; and to these were added milch cows, oxen, horses and mules, not represented functionally by anything in the native fauna. Chickens, geese and ducks were substituted for the prairie-hens, pigeons and wild waterfowl; and for the preservation of all these valuable but defenseless animals, wolves and bears and all the other large carnivora were virtually exterminated.

The result has been, of course, an immensely greater product of far more valuable and more readily available resources, sufficient for a population many thousand times greater and more exacting than any which formerly existed here. The whole process has evidently been a perfectly natural and inevitable one—as much so as the flow of the tide in the wake of the revolving moon—and immensely advantageous, also, from every point of view except that of the inadequate, incompetent and ill-adapted population which it has reduced or suppressed. These native populations were not, however, all unfit for survival under the dominant influence of civilized man, and such as were unfit were not equally so. Some were promptly and completely extin-

*"The Autobiography of Gurdon Saltonstall Hubbard." The Lakeside Press, Chicago, 1911, p. 57.

guished, others slowly and partially so; some remained undisturbed by our interference, and some continue more numerous and more prosperous to-day than ever before, because the new conditions established are more favorable to them than were the old. Wolves and wildcats, for example, were soon virtually suppressed as unmitigated nuisances, and buffalo, deer and the prairie hen went as early, or even earlier, because they could not be profitably domesticated, and could not breed, unprotected in the wild, fast enough to make good their losses. The fishes in our larger streams diminished slowly in numbers—if, indeed, taken as a whole, they diminished at all, until recent reclamation projects began to drain and cultivate their spawning places and feeding grounds—and the smaller plants and animals of our waters, upon which the fishes depend for food, were, until quite lately, at least as abundant as they ever were. No native insect species has disappeared from our borders, and several of the most abundant and voracious of them—the most injurious, consequently, to our interests—find a far better food in our cultivated crops, and, in our agriculture and horticulture, a system of management far better adapted to their needs, than was the original system which we have displaced. Our resident game birds would all have been gone long ago if it had not been for the restraints of law put upon the activities of the hunter, and the migrant game species are sadly reduced in numbers; but the smaller seed eaters, fruit eaters and insect eaters among birds are, I believe, more numerous now, on the whole, than they were in the days of the prairie, the Indian and the buffalo.

All the various processes of destruction, maintenance, protection, substitution and new introduction to which this state of our fauna is due are still in active operation; and they are in great measure as automatic and unreflecting, in respect to the motives behind them, as they ever were. Most men still act towards the wild life of the State precisely as if they were wild animals themselves, and seem to think no more of its future than does the hawk or the hungry wolf; but the *State,* as such, has recognized, of late, its responsibility to future generations, and is beginning to shape the course of events with forethought and intelligence in the permanent interests of its people. It is for this Academy to assist this movement, both by helping to popularize it and by contributing to its direction.

To give you an outline sketch of present conditions and tendencies over the whole field of zoölogy would take more time than

I have been allotted, and I can only summarize the facts and make brief suggestions of policy concerning our fishes, game animals and insectivorous birds.

The waters of the State have been much longer unaffected, and remain much less affected still, by human activities than any other parts of our area. Each of our rivers or lakes is yet, indeed, a piece of the primitive wilderness, which no one pretends to cultivate or to hold as such with a view to cultivation. It may have been greatly affected indirectly, in respect to its fitness as a home for plants and animals, by our various operations on its banks or in its neighborhood; but the picture of life presented by its waters, its bottom and its shores is still in its main features that of the days before the white man in America. In respect to the natural resources offered us by its plants and animals, we are lingering in the pioneer or squatter stage of progress, and we may still see belated illustrations of methods of appropriation in operation there, much too crude to be tolerated in any other field.

Almost nothing aquatic has been wholly exterminated, even the larger mammals and birds—the beaver, the otter, the swan, wild geese, pelicans and cranes—still remaining in small numbers in sufficiently favorable situations. Fishes, turtles, minks, muskrats, frogs and river mussels or clams remain as almost the only immediately valuable animal products of the waters of the State, and these are, on the whole, quite as valuable as they ever were.

No native fish has completely disappeared from our territory, although several useful species have been greatly reduced in numbers within recent years. The only comprehensive statistical reports upon the interior fisheries of the country have been made by the United States Fish Commission and the United States Census Bureau for 1894, 1899 and 1908. The second of these census years came just before the opening of the Chicago Drainage Canal in 1900, and the last one eight years after that revolutionary event, and ~~nine~~ twenty-three years after the introduction of the European carp into the public waters of this State. The two occurrences of critical importance within the period covered by these reports are thus the opening of the drainage canal and an enormous increase in the numbers of carp.

The drainage canal, by increasing the average depth of the Illinois River between two and a half and three feet, and greatly enlarging the area and lengthening the period of overflow, has

greatly extended the lateral range of the fishes of the river, especially in its middle course, enlarging at the same time their breeding grounds and feeding grounds, and bringing into the stream a tremendous load of sewage from Chicago and its suburbs. The first effect of such an enlargement of the aquatic area must be to scatter the normal fish population more widely and make it less accessible to the fisherman. On the other hand, the enlargement of their breeding and feeding grounds doubtless tends to an increase in the numbers of fishes by the better provision made for the survival of the young; while the final effect of sewage contamination upon the inhabitants of the stream will turn upon the manner in which these organic contributions are gradually worked up, through the ascending series of the plants and animals of the water, the margin, and the bottom, to bring them within the reach of fishes in some form of life available for their food.

The most interesting result I have obtained from an analysis and comparison of the three census reports referred to is an indication that the numbers of our native bottom-feeding fishes are being gradually diminished as an indirect consequence of the rapid and enormous multiplication of the introduced carp. This fish has now become so abundant, and commercially so important, that it is the main object of our commercial fisheries. The yield of the Illinois River, for example, was $412,000 worth of carp in 1908, while the value of all the other fishes taken from the stream that year was only $309,000. In 1894 the carp yielded, in Illinois, 860,000 pounds; five years later, nearly 10 million pounds; and nine years later still, 21,642,000 pounds—the *value* of this Illinois yield increasing in this period 27⅓ times, or from $21,000 to $574,000. The native coarse fish, on the other hand, which, like the carp, search the bottom of the stream for their food, yielded approximately 9½ million pounds in 1894, nearly 6¾ million pounds in 1899, and about 6¼ million pounds in 1908,—a loss of 29 per cent between 1894 and 1899, and of 7 per cent between 1899 and 1908.

The number of men employed during this period increased from 1,653 to 4,359, about 2⅔ times as many being engaged in fishing in 1908 as in 1894; and the investment in fishing equipment increased in the same period more than three and one-half times—from $156,000 to $553,000. That is, while fishing operations increased from two and one-half times to three and one-half times, and the product of European carp was multiplied over twenty-five times, the product of the bottom-feeding food fishes native in these waters fell off 29 per cent during the period before

the drainage canal was opened—a period coincident with that of the most rapid multiplication of the carp. This can only mean, it seems to me, that under the stimulus of fishing operations due to the rapidly growing importance of this exotic fish, the number of native fishes of similar habit is being rapidly reduced. The yield of buffalo was, in 1908, 52 per cent of that for 1894; that of the fresh-water drum, or sheepshead, was 60 per cent; of eels, 74 per cent; of suckers, 67 per cent. The catfish yield diminished 19 per cent for the first five years, and then increased 30 per cent for the next nine,—a net gain of 4 per cent, comparing 1908 with 1894.

Furthermore, the principal game fishes have also fallen off materially in yield, with the exception of the black bass, whose product increased about 6 per cent for each year of the first period and 36 per cent each year of the last. The sunfishes and the croppies, on the other hand, increased their product an average of 28 per cent for each of the first five years and of 26 per cent for each year of the last nine. Their rate of reproduction seems sufficient, under the new conditions, to hold them up under the new drain of excessive fishing for carp. These species all breed in shallow water and feed mainly on crustaceans, insect larvæ, and other minor forms of animal life, and their breeding grounds and feeding grounds have been enormously extended by the rise in river levels and the greater expansion and longer continuance of the overflow consequent upon the opening of the canal. Moreover, most of them select nesting places, makes nests, and care for their eggs and young, and hence bring to maturity a comparatively large percentage of each new generation.

Another important fact obtained from a comparison of our census data is the enormous and destructive increase of mussel-fishing in this State. The Illinois product of mussel-shells in 1894 was 24 tons, in 1899 it was 2,500 tons, and in 1908 it was 20,000 tons, with a value during the latter year of $184,000 for shells and $170,000 for pearls and slugs. This must, of course, result in the prompt destruction of the mussel population of our streams.

To summarize these statements in a sentence, it is plain that the clam fisheries of the State are being rapidly exhausted, and that the European carp is, with the aid of the fishermen, rapidly swamping and smothering out several of our native food fishes, both coarse and fine, excepting, however, the sunfishes and the black bass. This seems due not to direct competition between the native and the imported species, but to human interference under

the economic motive. We have here a substitution process at work, like that of our pioneer agriculture, but differing from that in the fact that it has been unintentional and hitherto unnoticed. If these present tendencies continue we shall apparently have, in time, our larger and more important fishing streams producing little but carp, sunfishes, black bass, gizzard-shad, dogfish, and gars, with even the catfishes engaged in a somewhat doubtful struggle for existence.

Several additional dangers now threaten the Illinois River, much the most important of our productive waters. It may become overloaded with sewage from Chicago and from the cities on its banks; the establishment of manufactories along its course or on its contributing waters may befoul it with chemical wastes poisonous to fish or injurious to their food supply, a process which has completely depopulated many streams in the eastern states, and which some of these states are now seeking to correct, at great expense and trouble, by legal restrictions and administrative control. Our recent work shows that the productivity of a stream is dependent upon the extent and condition of its backwaters and the period of its overflow, a fact which makes drainage district operations on the river bottoms a menace to its productiveness. The same is true of measures for straightening the stream and confining it to its channel, such as are likely to be necessitated if the Illinois is to become at any time a great artery of commerce.

These conditions require prompt, vigorous and intelligent rectification and control if we are to preserve and improve the natural resources represented in our lakes and streams—measures quite beyond the reach of any power except that of the State. If time permitted, I should be pleased to enter upon a discussion of various future policies necessary to this end, but I must pass it now with the general remark that the most important measures which should be taken at the present time are, in my judgment, the protection of our waters against injurious contaminations, especially from gas works and certain kinds of manufactories; and the preservation, intelligent care, and complete control of selected breeding grounds and feeding grounds of our most important fishes, to be acquired, held, and developed as permanent reservations by the State. The State Fish Commission has, in fact, made a beginning in this direction, and has lately secured a long-time lease of Matanzas Lake, in the Illinois bottoms, which it is preparing to use as a breeding station. It also seeks to main-

tain the supply of our more desirable fishes by hatchery operations, and by collecting young fishes from isolated overflow ponds and returning them to waters in which they can survive.

Whether the insectivorous birds of the State are of sufficient importance to be taken into serious account in cataloging our economic resources, is a question which can not be answered with the definiteness and precision which we are accustomed to expect as the outcome of anything worthy to be called strictly scientific investigation. The value of the services of birds depends upon the *kinds* of their food and the *ratios* of its various elements; upon the *variations* in their food and feeding habits as coördinated with differences of season, geographical situation, and ecological circumstance; upon the *amounts* of food eaten by birds of various species at various ages and under the various conditions of their activities; and upon the *numbers* of the various kinds of birds engaged in the economic services with which they are to be credited. The problem of the food of any bird is thus highly complex, and its primary data are so variable that even final conclusions, however broadly based, must be put in the form of approximate estimates and contingent probabilities, amounting to scarcely more than expressions of an enlightened personal judgment.

The quantities of food taken by birds, young and old, can not well be stated in terms of definite values, or masses, or numbers of individual objects eaten. Nevertheless, accumulated observations, continuous for days at a time, on the activities of parent birds of various species in feeding their young, furnish conclusive evidence of the fact that a family of nestlings may devour and assimilate a truly surprising amount of insect food; and the rapidity of growth and the high rate of physiological activity of birds as a class give theoretical support to statements which might otherwise seem incredibly exaggerated. The insects eaten by an insectivorous bird are evidently to be numbered in hundreds per day; and the weed-seeds eaten by a seed eater, in thousands.

With respect to the number of birds inhabiting any extensive area, the only systematic work attempted is that done in recent years by the Natural History Survey of this State. Thanks to this work, we now know something of the numbers of birds of various species in our area in different situations and at different seasons of the year. Time will not permit more than a brief reference to this matter, especially as our data have not yet been completely studied. I have generalized them, however, to the effect that, taking the State as a whole and the year as a unit, our

bird population averages something over a bird per acre for the open area of the State—excluding, that is, forests and other similar tracts on which accurate counting of birds is impracticable. This population varies greatly, of course, in density, according to the character and vegetable covering of the surface. Pastures contain, on the whole, more birds than any other open surface, and corn fields the fewest of all. The tendency of birds to concentrate where their food is especially abundant, and even to change their habits temporarily, in order to take advantage of an unusual profusion of certain elements of their food, greatly increases their economic value, since it makes them most efficient where their efficiency is most important. Nevertheless, the very fact that insectivorous birds thrive best when insects are most numerous must lead us to doubt that nature has really committed the blunder of producing birds in such numbers, and endowing them with appetites so vigorous, as to keep the natural sources of their own food supply much below the line of the highest possible productivity.

That birds are economically useful, scarcely admits of serious question, but the ultimate value of their services can scarcely be guessed at intelligently until much more work has been done on the problem. In the meantime, there are abundant reasons, both economic and esthetic, for their protection, and to this end the most important pending measure is the passage of national laws forbidding the destruction of migrant species—an interest which I would like to have this Academy promote by a resolution favoring the passage of the Anthony bill, now under consideration in the national House of Representatives.

The fur-bearing mammals of the State are by no means so nearly extinct as most of us would be likely to suppose. The mink and the muskrat remain in numbers still to figure in the United States census reports, the Illinois yield of mink furs being valued by the last census at $6,000 per annum, and the muskrat at $14,000. Even the otter has been reported to me by the deputy game wardens of Illinois[1] as still present in twenty-three counties, mainly in the southern half of the State, although a few reports come from the more northern counties bordering upon the Illinois and the Mississippi. The beaver is reported from four Ohio

[1] The data here given concerning the larger fur-bearing animals of the State I owe in great measure to the courtesy of Hon. John A. Wheeler, State Game Commissioner, who was kind enough to obtain for my use, and at my request, information from his deputy wardens throughout the State as to the present animal life of their respective counties. Reports have thus come to me, since this paper was begun, from eighty-five of the hundred and two counties of the State.

River counties; but the marten and the fisher have long been extinct in this State.

Among the larger mammals we have lost the elk, the buffalo, the panther or puma, and the black bear. The Virginia deer is still sometimes seen in southern Illinois, but hunters there believe that it crosses the river from Missouri, and does not breed within our limits. Its occasional occurrence in several of the more northern counties is to be attributed to its escape from parks. Both the prairie-wolf and the timber-wolf are widely distributed in very small numbers, one or both of these having been lately seen, according to the deputy wardens, in at least forty-three Illinois counties. Lynxes and wildcats have been lately reported from fourteen counties, seven of which are in extreme southern Illinois. Red and gray foxes are found by the game wardens in forty counties; and the raccoon and the opossum are common enough to be hunted occasionally. The woodchuck holds its own fairly well in the northern part of the State, and the swamp-hare may yet be found in our southern cypress swamps. The common rabbit is, of course, everywhere abundant. The fox-squirrel and the gray squirrel still live in our woods in scanty numbers, and the red squirrel or chickaree occurs at present in Iroquois County, where, however, it was specially introduced. The badger is undoubtedly to be found in northern Illinois; and skunks and weasels are, of course, still with us, although in smaller numbers than formerly.

The really significant game of the State is virtually reduced, however, to wild ducks, shore-birds, prairie-hens, quail, and the plebeian rabbit. Quail are found, in fact, in every county; and prairie-hens—thanks to our protective laws—are now to be seen in at least seventy-four counties, so abundantly in some that farmers are beginning to protest against their further increase because of the amount of grain which they devour. Wild turkeys occasionally occur in the more broken, wooded country, but too rarely to offer any considerable inducement to the hunter. In short, with the exception of the elk, buffalo, and bear, we have the larger forms of the wild mammalian animals of the State, and most of the game birds also, still present to an extent such that we need only to protect them strictly to have them back again in any numbers which can find food, shelter, and safety in their present environment. That this must at best fall far short of their original abundance is shown by the results of the recent

protection of the prairie-hen. The very country in which it was formerly most numerous—that is, the open prairie—is now least favorable to it because of the agricultural operations, which disturb and destroy it during its breeding season.

Time has failed me, in the preparation of this brief paper, to enter into particulars concerning the work of the state commissions now engaged in maintaining and protecting the valuable wild animals of the State and in improving the composition of our fauna by the introduction of exotic species. These are the State Fish Commission and the State Game Commission, to which reference has already been made. The biennial reports of the former, some fifteen in number, give a sufficient account of their work. The State Game Commissioner has not yet published regular reports of his operations, but they are described in a brief but comprehensive illustrated article printed in the Arbor and Bird Day Circular issued by the State Superintendent of Public Instruction in 1909.